ATSDR Record of Activity

ORIGINAL

UID #:_ __ _ Date: 06 / 01 / 2005 Time: 10:30 am X pm

Site Name: Elkton Farm Firehole City: Elkton Cnty: Cecil State: MD

CERCLIS #:___ Cost Recovery #: 3ADH Region: III

Site Status (1) NPL X Non-NPL _ RCRA _ Non-Site specific _ Federal
(2) _ Emergency Response _ Removal X Other

Activities

_ Incoming Call _ Public Meeting* _ Health Consult* _ Site Visit*
_ Outgoing Call _ Other Meeting _ Health Referral _ Info Provided
_ Conference Call X Data Review X Written Response _ Other

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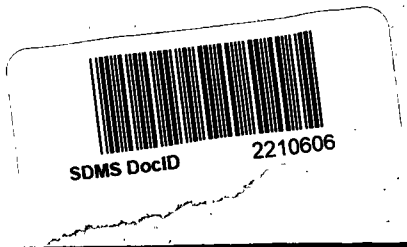
Program Areas

_ Health Assessment _ Health Studies _ Tox Info-profile _ Worker Health
_ Petition Assessment _ Health Surveill _ Tox Info-Nonprofit _ Admin
_ Emergency Response _ Disease Registry _ Subst-Spec Resch X Other
x Health Consultation _ Exposure Registry _ Health Education

Narrative Summary: In April 2005, EPA Region 3 asked ATSDR Region 3 to evaluate the potential public health impact of explosives-contaminated soils under current and future use scenarios at the Elkton Farms Firehole Superfund site. The explosives contaminants are 2,4,6-trinitrotoluene and its degradation products. Currently, the site is used for farming, and EPA would like to know if the contamination poses a public health threat for people or animals consuming the crops from the property. In the future, the site is proposed for residential development, and EPA would like to know if the contamination might pose a public health threat for people who might live on the property.

EPA is working with the Maryland Department of the Environment (MDE) to complete a Formerly Used Defense Site (FUDS) evaluation of the Elkton Farm Site. The Elkton Farm Site is located in a rural area two miles southwest of Elkton, Maryland near the intersection of Routes 40 and 279. The contaminated Firehole portion of the site consists of a series of burn pits located across approximately 32 acres of the overall 400-acre Elkton Farm. The site currently and historically has functioned as a working farm, but during the decade before and during World War II the Firehole portion of the property was also used for the manufacture of fireworks and munitions.1

1 Maryland Department of the Environment, Waste Management Administration. Formerly Used Defense Site Inspection of the Elkton Farm Firehole Site (MD-433). November 2003.



ATSDR evaluated the surface soil, groundwater, surface water, and sediment data available for the Firehole portion of the property. We compared the sampling data against health-based screening values. Concentrations below a screening value are generally considered not of public health concern. Concentrations above a screening value are not necessarily a health threat, but do require further evaluation.

SAMPLING DATA

In October 2002, MDE collected 14 surface soil samples, ten subsurface soil samples, six surface water samples, and six sediment samples and analyzed them for metals and cyanide, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides and polychlorinated byphenyls (PCBs), perchlorates, and nitroaromatic compounds. ATSDR focused on the surface soil samples in our evaluation, as opposed to the soil samples from depths, because surface soil samples are the most indicative of actual public health exposures. Note, perchlorate, a contaminant of concern at some FUD sites, was not detected in any environmental media on this site.

- The highest detections of VOCs, SVOCs, and nitroaromatic compounds in the surface soil samples were found at S13 and S14, which were obtained from directly in the Firehole.
  - o Trichloroethene at S14 (160 ppb) exceeded a health-based screening value, and was also elevated but did not exceed the screening value at S13 (37 ppb).
  - o Several PAHs (benzo(a)pyrene, benzo(a)anthracene, benzo(B)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene) concentrations exceeded chronic cancer health-based screening values at S14.
  - o Two pesticide concentrations (toxaphene at 610 ppb at S12 and DDT at 1,400+ ppb at S13) very slightly exceeded or approached health-based screening levels. Sample S5, which was a duplicate of S12, did not have the same detections of pesticides as S12.
  - o Lead was detected in S14 at 1,480 ppm, which would exceed a health-based screening level for a residential soil. Cadmium was elevated at S14, and this concentration (12.5 ppm) slightly exceeded a child chronic health-based screening level. Arsenic was detected from 2.7 - 5.6 ppm; these levels slightly exceed a chronic cancer health-based screening value. However, the arsenic levels across all of the surface soil samples were comparable to the level in the background sample (2.7 ppm) from the site and do not appear to be elevated from site-related contamination.
  - o Nitroaromatic compounds (1,3,5-trinitrobenzene, 2,4,6-trinitrotoluene, 4-aminio 2,6-dinitrotoluene, 2-aminio 4,6,dinitrotoluene and dinitrotoluene mix) were detected in surface soil samples S3, S6, S8, S13, and S14. These levels did not exceed health-based screening levels, with the exception of dinitrotoluene compounds at S6 (1,530 ppb 4-amino 2,6-dinitrotoulene and 1,260 ppb 2-amino 4,6-dinitrotoluene).
- One of the sediment samples (SED5) had detections of all inorganics over three times background, but below health-based screening values for

•human dermal/ingestion contact with this sediment.2

In May 2003, MDE collected five groundwater samples from site monitoring wells and analyzed them for total and dissolved metals, VOCs, SVOCs, pesticides and PCBs, nitroaromatic compounds, and perchlorates. MDE also collected a water sample from a domestic well at this time to evaluate background groundwater conditions.

- Health-based screening levels for two VOCs were exceeded in the two samples from the onsite groundwater monitoring well MW-2; trichloroethylene (TCE) was detected at 190 ug/L and 170 ug/L, and 1,1,2-trichloroethene was detected at 5 ug/L.
- A trace level (below a health-based screening value) of 4-amino-2,6-dinitrotoluene (.015 ug/L) was also detected in one of the two samples from MW-2.
- Levels of arsenic, lead, and manganese exceeded health-based screening values in the total metals analysis of a few of the groundwater samples. The highest level of total manganese (1,250 ug/L) was detected in the background monitoring well sample (MW-1). Furthermore, the concentration of this metal in MW-1 was reduced below health-based screening levels to 221 ug/L in the dissolved metals analysis. Arsenic was detected at approximately 6 ug/L in MW-3 and below the detection limit in the remaining total metals analyses; it was not present in any of the dissolved analyses. Lead was detected from 11 - 28.5 ug/L in the total analyses, with the highest level found in the background monitoring well sample MW-1, and again was not detected in any of the dissolved metals analyses.
- No perchlorates were detected in any of the groundwater samples.3

Further surface and subsurface soil sampling at the site was conducted in 2004 and 2005 to evaluate the areas within the suspected Firehole for munitions-related contamination. In December 2004 and January 2005, 12 surface soil samples and 12 subsurface soil samples were collected and analyzed for inorganics, organics, perchlorates, and nitroaromatic compounds.

- For the inorganics analysis of the surface soil samples, arsenic, lead, and cadmium levels again exceeded health-based screening levels in a few of the samples. The highest concentrations in this sampling round for these three metals were reported at S2. Arsenic concentrations ranged from 3-9.5 ppm. Lead concentrations were higher than reported in previous investigations, and ranged from 295-852 ppm, with higher concentrations at depth samples like SS12 and its duplicate SS5 (2,620 and 2,860 ppm, respectively). Cadmium levels in this investigation ranged from 6.5-13.6 ppm.4

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2 Maryland Department of the Environment, Waste Management Administration. Formerly Used Defense Site Inspection of the Elkton Farm Firehole Site (MD-433). Final. September 15, 2004.

3 Maryland Department of the Environment, Waste Management Administration. Formerly Used Defense Site Inspection of the Elkton Farm Firehole Site (MD-433). Final. September 15, 2004.

4 U.S. EPA Inorganic Data Validation Report for the Elkton Farm Site. Submitted from Khin-Cho Thaung, Region 3 ESAT RPO to Lorie Baker, EPA Site Assessment Manager, February 14, 2005.

- For the organics analysis of the surface soil samples, TCE was the only contaminant that exceeded a health-based screening level at one location (S1, 37 ppb). Higher concentrations were reported at depth at SS12 and its duplicate SS5 (140 and 62 ppb, respectively).5

In March 2005, and additional 18 soil samples were analyzed for nitroaromatic compounds.

- Various nitroaromatic compounds (1,3,5-trinitrobenzene, 2,4,6-trinitrotoluene, 4-aminio 2,6-dinitrotoluene, 2-aminio 4,6,dinitrotoluene and other dinitrotoluene isomers) were again detected in surface soil samples during this sampling event. During this sampling round, some of the surface soil concentrations exceeded health-based screening levels for TNT and dinitrotoluene at sampling locations S7 and S12. Both of these samples contained such high concentrations of the target analytes that they required dilution for analysis; in particular, the dilution of S7 to bring the TNT concentration into analytical range resulted in other nitrosamine compounds in this sample being diluted below quantitation limits. The TNT concentration at S7 was 1,300 ppm, and at S12 was 192 ppm.6

EVAULATION OF CURRENT CROP CONSUMPTION PATHWAY

Winter wheat and soybeans are grown on the property and sold for direct human consumption. Corn is grown on the property for livestock consumption. Actual contamination levels in the crops are not available at this time.

ATSDR reviewed available scientific literature on uptake of nitrosamine compounds by plants. Plants grown in TNT-contaminated soils and water appear to absorb TNT from the environmental media and biotransform the toxic contaminants to less toxic or non-toxic metabolites. For example, Datura innoxia (Jimson weed) grown in cell cultures was able to decolorize "pink water" over night, removing TNT from greater than 100 ppm to undetectable levels. A wild tomato species, Lycopersicon peruvianum, was also found to rapidly (within 24 hours) biotransform TNT in cell cultures. Greenhouse studies of whole plants of these species confirmed these results. Plants were grown in soil contaminated with TNT in concentrations of 100, 150, 250, 500, 750, 1000 ppm. In this study, all plants grew well in soils with TNT levels up to 500 ppm, with slight detrimental effects in both Datura and Lycopersicon observed at 750 ppm, and moderate stress in the Lycopersicon plants and slight affects on the Datura plants at 1,000 ppm. At the lower concentrations of TNT in soil, more of the contaminant was translocated from the roots into stems and leaves as compared to the higher concentrations (i.e., 500 ppm or more). In this study, no TNT was translocated into the aboveground parts of either species, and even in the roots at least 99% of the contamination detected was present as metabolites.7 In another study

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5 U.S. EPA Organic Data Validation Report for the Elkton Farm Site. Submitted from Khin-Cho Thaung, Region 3 ESAT RPO to Lorie Baker, EPA Site Assessment Manager, January 31, 2005.
6 Elkton Farms Final Data for 18 Soil Samples Collected on March 7, 2005, submitted by Jennifer Gundersen, U.S. EPA and provided via e-mail to ATSDR from Lorie Baker, EPA Site Assessment Manager.
7 Mueller, WF, GW Bedell, S. Shojaee, and PJ Jackson. Bioremediation of TNT Wastes by

evaluating uptake and phytotoxicity of TNT in onion plants grown hydroponically, researchers found that of total TNT mass, 75% was in the roots, 4.4% in the leaves, and 21% in the external solution after two days. The percent distribution in roots was lower with higher concentrations of TNT, but in leaves it was comparable in all concentrations.8 Another study evaluated seed germination and early stage seedling growth tests of two dicotyledons (Lepidium sativum L. or cress and Brassica rapa Metz or turnip) and two monocotyledons (acena sativa L., or oat and Triticum aestivum L., wheat). The cress and turnip plants showed higher sensitivities to TNT than the oat and wheat plants. In contrast to high TNT concentrations, at low levels of TNT in this study (i.e., 5-25 ppm for cress and turnip and 25-50 ppm for oat and wheat), seedling growth was stimulated. Oat was capable of tolerating as much as 1,600 ppm TNT.9

ATSDR also consulted with a subject matter expert on TNT toxicology, who confirmed that concentrations of TNT in plants grown in TNT-contaminated soils should be insignificant.10

Therefore, ATSDR concludes that although there is most likely variability in the uptake and biotransformation of nitrosamine compounds in different species of plants, we do not expect adverse human health effects from consumption of crops grown at this site.

EVAULATION OF FUTURE RESIDENTIAL PATHWAY

According to the EPA SAM, existing local public water supplies may not be sufficient to meet the needs of the proposed future residential development at this site. A private water system may need to be developed for the proposed complex using local surface or ground water supplies. Therefore, the drinking water pathway is a potential future route of exposure at this site. This pathway cannot be fully evaluated at this time, because a water supply option has not yet been chosen (and therefore no specific sampling results for this pathway are available for review).

ATSDR does not expect that chemical concentrations detected in the surface soil collected from the Firehole portion of the site will pose a public health concern for adults or children residing on the site in the future, if appropriate measures are taken to prevent regular contact with the hot spots of contamination identified. Examples of the hot spots of contamination include the TNT contamination at S7 from the March 2005 sampling event, and the metals contamination at S2 from the December 2004/January 2005 sampling event. This is particularly true of the areas of highest contamination are not used as residential areas or areas where children would regularly

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Higher Plants. Proceedings of the 10th Annual Conference on Hazardous Waste Research. 2222-230.

8 Kim, J and MC Drew. Uptake and Phytotoxicity of TNT in Onion Plant. J Environ Sci Health A Tox Hazard Subst Envrion Eng. 2004;39(3):803-19.

9 Gong P, B Wilke, and S Fleischmann. Soil-Based Phytotoxicity of 2,4,6-TNT to Terrestrial Higher Plants. Arch Environ Contam Toxicol. 1999 Feb;36(2):152-7.

10 Personal conversation. Dr. Mark Johnson, Environmental Toxicology, Health Effects Research Program, U.S. Army Center for Health Promotion and Prentative Medicine, with Dr. Karl Markiewicz, ATSDR Region 3, May 2005.

frequent; current proposals indicate that the developers may use the Firehole portion of the site for stormwater management wetland areas.

ATSDR is unable to comment on the possibility of vapor intrusion as potential exposure pathway to future residents at this time. Because there is a plume of TCE-contaminated groundwater at this site, and the depth to groundwater is expected to be ~20 feet, this pathway will need to be evaluated further if development plans proceed at this site.

It is important to note that ATSDR's conclusions regarding exposures to future residents at this site are limited by two major factors: (1) we do not know the actual specifics for the future development at this site (e.g., source and quality of drinking water supplied to residents, locations of actual future residences, construction characteristics of future residences, fill material that may be placed in residential areas, etc.). Furthermore, the entire 400-acre property is very large, and ATSDR only reviewed environmental data for the 32-acre Firehole portion.

Action Required/Conclusions/Recommendations/Info Provided:

- ATSDR does not expect adverse human health effects from consumption of crops grown at this site.
- Because site-related contamination was documented in ground water samples from this site, drinking water supply options for the proposed residential development will need to be carefully evaluated and appropriate treatment implemented, as needed.
- ATSDR does not expect that chemical concentrations in surface soil will pose a public health concern for adults or children residing on the site in the future, if appropriate measures are taken to prevent regular contact with the hot spots of contamination identified in the various sampling investigations of this site.
- Because there is a plume of TCE-contaminated groundwater at this site, and the depth to groundwater is expected to be ~20 feet, this pathway will need to be evaluated further if development plans proceed at this site.

ATSDR's conclusions and recommendations are based upon the available information. If additional or new information becomes available, ATSDR is available to review the information and provide a determination as to the public health significance.

Lora S. Werner, MPH

Signature: _____ Date:_____

Karl V. Markiewicz, Ph.D.

Signature: _____ Date:_____